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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] In this invention, about improvement of the optic used for optical apparatuses, such as an optical head which project light spot on disk shape recording media, such as CD, and performs record reproduction of the information over a recording medium, especially, PBS prism, a wavelength plate, and a dichroic prism are unified, and it is considered as a single synthetic light faculty article. Therefore, it is related with the optical head which aimed at cost cut by reduction of part mark, and improvement in productivity.

[0002]

[Description of the Prior Art] The optical disk unit which performs record of information and playback on disk shape recording media, such as CD and DVD, using a laser beam projected the spot of the laser beam emitted from the laser light source on the recording surface of the recording medium, recorded it, and is provided with the optical head for playing. Drawing 5 is an outline lineblock diagram showing an example of the optical head carried in such an optical disk unit. The 1st laser diode (it is hereafter described as the 1st LD) 2 in which this optical head 1 generates the 1st laser beam L1 (for example, 630 nm which is the wavelength for CD record reproduction), The polarization beam splitter (PBS) prism 3 which functions as entering the 1st laser beam L1 emitted from the 1st LD2, passing only P polarization component with the PBS film 3a, and not passing S polarization component, The 1/4 wavelength plate 4 made to rotate the plane of polarization of P polarization component of the 1st laser beam L1 that penetrated the PBS prism 3 90 degrees, It has the dichroic prism 5 which makes the 1st laser beam L1 that penetrated the 1/4 wavelength plate 4 penetrate, and the rising mirror 6 which turns to a disk shape recording medium the 1st laser beam L1 that penetrated the dichroic prism 5, and is reflected. The optical path which faces to a disk shape recording medium constitutes the 1st optical path from the 1st LD2. Returned light L1' which the 1st laser beam L1 reflected by the disk, After reflecting by the rising mirror 6, the dichroic prism 5 is penetrated, and plane of polarization is rotated in the direction further 90 degrees with

the 1/4 wavelength plate 4, it becomes S polarization, S polarization component is reflected by the PBS film 3a of the PBS prism 3, and light is received with the photo detector (PD) 7. The PBS prism 3 is provided with the composition which sandwiched the PBS film 3a between the inclined planes of triangular prism glass of two sheets, and passes only P polarization component. The 1/4 wavelength plate 4 comprises anisotropic crystals boards, such as crystal, or a high polymer resin film, and has rotated the plane of polarization of the inputted laser beam 90 degrees. Between the inclinations of triangular prism glass of two sheets, the dichroic prism 5 is provided with the composition which sandwiched the reflective demarcation membrane 5a, and reflects only an ingredient with a wavelength of 780 nm in this example.

[0003]The 2nd laser diode (the 2nd LD) 11 in which this optical head 1 emits the 2nd laser beam L2 (for example, wavelength of 780 nm for DVD record reproduction) further, Having the dichroic prism 5 made to reflect only an ingredient with a wavelength [in the 2nd laser beam L2] of 780 nm by the reflective demarcation membrane 5a, and the rising mirror 6, these constitute the 2nd optical path. LDof ** 2nd 2 is provided with the composition which put side by side the photo detector which equipped the acceptance surface with the hologram. Returned light L2' of the 2nd laser beam L2 reflected in the recording surface of the disk shape recording medium enters into the photo detector which is reflected by the reflective demarcation membrane 5a of the dichroic prism 5 and with which the 2nd LD11 is provided, after reflecting by the rising mirror 6. Returned light L1' from a disk shape recording medium, and as a result of L2's entering into each acceptance surface of the photo detector 7 and 2nd LD11, respectively, the output signal (electrical signal) according to each returned light L1' and L2' is outputted from the photo detector 7 and the 2nd LD11. Signal processing of these output signals is carried out in the control circuit which is not illustrated, and the information currently recorded on the disk shape recording medium is reproduced.

[0004]

[Problem(s) to be Solved by the Invention]Since the optical head provided with the composition like the above has many part mark in the 1st optical path, it has fault of increase of manufacture trouble, increase of component cost, and also enlargement. When the further miniaturization was strongly demanded from an optical head by the miniaturization of the apparatus which carries an optical head especially, in the optical head of the above-mentioned composition, the miniaturization had a limit. Since the PBS prism 3, the 1/4 wavelength plate 4, and the dichroic prism 5 all comprise glass, crystal, etc., a part of incident light or emitted light reflects by an interface with air, and they bring about fault. In order to prevent this catoptric light, it is necessary to certainly coat the square and crystal portion used as the entrance plane of each optics 3, 4, and 5, and an emission face with an antireflection film. However, when mass-producing each optic, in order to incorporate the process of coating each ON emission face with an antireflection film, on equipment and a procedure, a big loss occurs and it has become a cause of the cost hike and the productivity slowdown. Then, there is the issue which this invention tends to solve in compounding two or more optics used for optical apparatuses, such as an optical head which project light spot on disk shape recording media, such as CD, and performs record reproduction of the information over a recording medium, as much as possible, and considering it as a single optic. The optical head which aimed at cost cut by reduction of part mark and improvement in productivity is provided by unifying PBS

prism, a wavelength plate, and a dichroic prism, and considering it as a single synthetic light faculty article especially. It makes it possible to abolish the necessity of applying an exceptional antireflection film to the ON emission face of the above-mentioned synthetic light faculty article, and to reduce manufacture trouble and a manufacturing cost.

[0005]

[Means for Solving the Problem] In order to solve an aforementioned problem, an invention of claim 1 is projected on a recording surface of a disk shape recording medium turning around a spot of the 1st and 2nd laser beams emitted from the 1st and 2nd laser light sources, respectively. The 1st optical path that is an optical head which performs writing of information, and read-out, and has arranged said 1st laser light source, PBS prism, 1/4 wavelength plate, and a dichroic prism one by one, In a thing provided with the 2nd optical path that comprises said 2nd laser light source with a hologram, and said dichroic prism, said PBS prism, 1/4 wavelength plate, and a dichroic prism were unified, and it was considered as a single synthetic light faculty article. an invention of claim 2 was provided with a synthetic light faculty article which has the composition which laminate integration of the PBS coat film was carried out to the whole surface of a glass substrate, and said glass substrate was alike on the other hand, and carried out laminate integration of 1/4 wavelength plate and the die clo coat film one by one an invention of claim 3 was provided with a synthetic light faculty article which has the composition which laminate integration of 1/4 wavelength plate and the PBS coat film was carried out to the whole surface of a glass substrate one by one, and said glass substrate was alike on the other hand, and carried out laminate integration of the die clo coat film an invention of claim 4 was provided with a synthetic light faculty article which has the composition which laminate integration of the PBS coat film was carried out to the whole surface of the 1st glass substrate, and this 1st glass substrate was alike on the other hand, and carried out laminate integration of 1/4 wavelength plate, the 2nd glass substrate, and the die clo coat film one by one an invention of claim 5 was provided with a synthetic light faculty article which has the composition which laminate integration of the PBS coat film was carried out to the whole surface of said 1/4 wavelength plate, and this 1/4 wavelength plate was alike on the other hand, and carried out laminate integration of the die clo coat film An invention of claim 6 is provided with a synthetic light faculty article which has the composition which separated a necessary interval and has arranged an PBS coat film, 1/4 wavelength plate, and a die clo coat film one by one inside a glass block.

[0006]

[Embodiment of the Invention] Hereafter, this invention is explained in detail based on the embodiment shown in the drawing. Drawing 1 is the composition of the optical head using the synthetic light faculty article concerning a 1st embodiment of this invention a shown schematic illustration, and this optical head 11, The 1st laser diode (it is hereafter described as the 1st LD) 12 that generates the 1st laser beam L1 (for example, 630 nm which is the wavelength for CD record reproduction), The synthetic light faculty article 13 made to emit after entering the 1st laser beam L1 emitted from the 1st LD (1st laser light source) 12, and making only P polarization component penetrate and rotating a plane of polarization 90 degrees, Having the rising mirror 14 which is made to reflect the emitted light from the synthetic light faculty article 13, and is led to a disk shape recording medium, these constitute the 1st optical path. It reflects by the rising mirror 14, and returned light L1' of the 1st laser beam L1 reflected with the disk shape recording

medium rotates a plane of polarization 90 degrees further in the synthetic light faculty article 13, and is received by the photo detector (PD) 15. The synthetic light faculty article 13 shown in drawing 1 is the standard type shown in drawing 2 (a), Laminate integration of the PBS coat film 22 is carried out to the whole surface (entrance plane of the 1st laser beam L1) of the glass substrate 21 with necessary thickness, and it has the composition of said glass substrate which, on the other hand (emission face of the 1st laser beam L1), carried out laminate integration of the 1/4 wavelength plate 23 and the die clo coat film (reflective demarcation membrane) 24 one by one. The PBS coat film 22 has the function to reflect S polarization component in the 1st laser beam L1, and to make only P polarization component penetrate, The 1/4 wavelength plate 23 has the function to rotate the plane of polarization of P polarization component 90 degrees, and while the die clo coat film 24 makes a laser beam with a wavelength of 630 nm penetrate, it has the function to reflect a laser beam with a wavelength of 780 nm. Returned light L1' which the 1st laser beam L1 reflected by the disk, After reflecting by the rising mirror 14, the die clo coat film 24 is penetrated, and plane of polarization is rotated in the direction further 90 degrees with the 1/4 wavelength plate 23, it becomes S polarization, S polarization component is reflected with the PBS coat film 22, and light is received with the photo detector (PD) 15. This optical head is provided with the 2nd laser diode (the 2nd LD) 25 that emits the 2nd laser beam L2 (for example, wavelength of 780 nm for DVD record reproduction), The 2nd laser beam L2 emitted from the 2nd LD(2nd laser light source) 25 is led to the rising mirror 14 with the die clo coat film 24 made to reflect only the 2nd laser beam L2, and is irradiated by the Dix-like recording medium. These constitute the 2nd optical path.

[0007]The 2nd LD25 is provided with the composition which put side by side the photo detector which equipped the acceptance surface with the hologram. Returned light L2' of the 2nd laser beam L2 reflected in the recording surface of the disk shape recording medium enters into the photo detector which is reflected with the die clo coat film 24 and with which the 2nd LD25 is provided, after reflecting by the rising mirror 14. Since the synthetic light faculty articles 13 provided with the above-mentioned composition are single parts which had simultaneously the function of the conventional PBS prism, 1/4 wavelength plate, and die clo prism, Reduction of the attachment trouble of parts and simplification of attachment structure are attained, low-cost-izing and improvement in productivity can be realized, and an optical path can be shortened and an optical head can be miniaturized. And since this synthetic light faculty article 13 is a plate type, it can simplify a manufacturing process. That is, since it can manufacture by laminating the PBS coat film 22, the 1/4 wavelength plate 23, and the die clo coat film 24 to each field of the glass substrate 21, respectively, manufacture trouble is simplified substantially. Since the PBS coat film 22 is laminated by the entrance plane of the glass substrate 21 and the 1/4 wavelength plate 23 and the die clo coat film 24 are laminated by the emission face, it becomes unnecessary for a glass substrate surface to touch air, therefore to make an antireflection film placed between the interfaces of a glass substrate surface and air at the conventional time. In drawing 1, adjacent arranging of the photo detector 15 and the 2nd LD25 is carried out by vertical position relations. The photo detector 15 receives returned light L1' of the 1st laser beam reflected 90 degrees with the PBS coat film 22 provided in the synthetic light faculty article 13 with this single, since the 2nd LD25 is arranged in the position which can emit the 2nd laser beam L2 towards the die

clo coat film 24 so that it may intersect perpendicularly with the 1st laser beam L1 in this side of the rising mirror 14, close arrangement of the photo detector 15 and the 2nd LD25 is carried out -- things -- ** And the distance between the photo detector 15 and the 2nd LD25 can be variously adjusted by making the thickness of the glass substrate 21, and the thickness of the wavelength plate 23 fluctuate. The relation between the thickness of a glass substrate, and the distance between the photo detector 15 and the 2nd LD25, When the optical glass whose refractive index n it is as being shown in [drawing 3](#), for example, is about 1.5 as the glass substrate 21 is used, in order for the distance between the photo detector 15 and the 2nd LD25 to be 4 mm, the thickness of the glass substrate 21 needs to be about 5 mm.

[0008]Next, [drawing 2](#) (b) is the 1st modification of the synthetic light faculty article 13 of the plate type shown in [drawing 2](#) (a) a shown sectional view, and this synthetic light faculty article 13, laminate integration of the 1/4 wavelength plate 23 and the PBS coat film 22 is carried out to the whole surface (entrance plane) of the glass substrate 21 one by one, and it has the composition which the glass substrate 21 was alike on the other hand, and carried out laminate integration of the die clo coat film 24. The synthetic light faculty article 13 concerning this 1st modification is equivalent to the synthetic light faculty article of [drawing 2](#) (a), if the composition which has arranged the glass substrate 21 between the 1/4 wavelength plate 23 and the die clo coat 24 is removed. If it puts in another way, the composition which united the layered product of the PBS coat film 22 and the 1/4 wavelength plate 23 with the entrance plane side of the glass substrate 21, and also carried out laminate integration of the die clo coat 24 to the emission face side is characteristic. However, since there is no influence in the characteristic even if it arranges the glass substrate 21 in which position between the PBS coat film 22, the 1/4 wavelength plate 23, and the die clo coat 24, such arrangement is possible for it. Therefore, the two glass substrates 21A and 21B may be arranged like the 2nd modification shown in [drawing 2](#) (c) between the PBS coat film 22 and the 1/4 wavelength plate 23 and between the 1/4 wavelength plate 23 and the die clo coat 24, respectively. Since the synthetic light faculty article 13 concerning the 2nd modification of [drawing 2](#) (c) has the composition which sandwiched the 1/4 wavelength plate 23 by the both glass substrates 21A and 21B, it becomes possible to use wavelength plates made of resin other than anisotropic-crystals boards, such as a quartz plate, as the 1/4 wavelength plate 23. That is, if it is in the synthetic light faculty article of [drawing 2](#) (a) and (b), since the PBS coat film 22 and the die clo coat film 24 will be formed by vacuum evaporation etc. to the 1/4 wavelength plate 23, only the anisotropic-crystals board provided with rigidity as the 1/4 wavelength plate 23 is employable. If it puts in another way, since it is difficult to vapor-deposit the PBS coat film 22 and the die clo coat film 24 to a weak resin wavelength plate with heat, Although only an anisotropic-crystals board can be used in [drawing 2](#) (a) and (b), since it is the composition which sandwiches the 1/4 wavelength plate 23 between glass substrates in this invention, use of the wavelength plate made of resin is possible. Next, [drawing 2](#) (d) is a sectional view of the 3rd modification of the synthetic light faculty article of this invention, and this synthetic light faculty article, Laminate integration of the PBS coat film 22 is carried out to the whole surface (entrance plane) of the 1/4 wavelength plate 23 which comprises anisotropic-crystals boards, such as a quartz plate, and it has the composition of this 1/4 wavelength plate 23 which, on the other hand (emission face), carried out laminate integration of the die clo coat film 24. When this

type of synthetic light faculty article 13 is used, it is possible to make the distance between the photo detector 15 and the 2nd LD25 approach about 100 micrometers. When putting in another way and the integration made to approach about 100 micrometers is attained in the distance between the photo detector 15 and the 2nd LD25, it can respond by using the overly laminated synthetic light faculty article 13 of the type shown in drawing 2 (d), and it becomes possible to miniaturize an optical head substantially.

[0009]Next, drawing 4 is a figure showing the composition of the optical head using the synthetic light faculty article concerning a 2nd embodiment of this invention. The 1st laser diode (it is hereafter described as the 1st LD) 32 in which this optical head 31 generates the 1st laser beam L1 (for example, 630 nm which is the wavelength for CD record reproduction), The synthetic light faculty article 33 made to emit after entering the 1st laser beam L1 emitted from the 1st LD32, and making only P polarization component penetrate and rotating a plane of polarization 90 degrees, Having the rising mirror 34 which is made to reflect the emitted light from the synthetic light faculty article 33, and is led to a disk shape recording medium, these constitute the 1st optical path. It reflects by the rising mirror 34, and returned light L1' of the 1st laser beam L1 reflected with the disk shape recording medium rotates a plane of polarization 90 degrees further in the synthetic light faculty article 33, and is received by the photo detector (PD) 35. The synthetic light faculty article 33 shown in drawing 4 has the composition which unified the PBS prism 3 shown in drawing 5, the 1/4 wavelength plate 4, and the dichroic prism 5. That is, composition provided with the composition which separated the necessary interval to glass block 40 inside, and has arranged the PBS coat film 41, the 1/4 wavelength plate 42, and the die clo coat film 43 one by one characterizes this synthetic light faculty article 33. The PBS coat film 41 has the function to reflect S polarization component in the 1st laser beam L1, and to make only P polarization component penetrate, The 1/4 wavelength plate 42 has the function to rotate the plane of polarization of P polarization component 90 degrees, and while the die clo coat film 43 makes a laser beam with a wavelength of 630 nm penetrate, it has the function to reflect a laser beam with a wavelength of 780 nm. Returned light L1' which the 1st laser beam L1 reflected by the disk, After reflecting by the rising mirror 34, the die clo coat film 43 is penetrated, and plane of polarization is rotated in the direction further 90 degrees with the 1/4 wavelength plate 42, it becomes S polarization, S polarization component is reflected with the PBS coat film 41, and light is received with the photo detector (PD) 35.

[0010]This optical head is provided with the 2nd laser diode (the 2nd LD) 36 that emits the 2nd laser beam L2 (for example, wavelength of 780 nm for DVD record reproduction), The 2nd laser beam L2 emitted from the 2nd LD36 is led to the rising mirror 34 with the die clo coat film 43 made to reflect only the 2nd laser beam L2, and is irradiated by the Dix-like recording medium. These constitute the 2nd optical path. The 2nd LD36 is provided with the composition which put side by side the photo detector which equipped the acceptance surface with the hologram. Returned light L2' of the 2nd laser beam L2 reflected in the recording surface of the disk shape recording medium enters into the photo detector which is reflected with the die clo coat film 43 and with which the 2nd LD36 is provided, after reflecting by the rising mirror 34.

[0011]Since the synthetic light faculty articles 33 provided with the above-mentioned composition are single parts which had simultaneously the function of the conventional PBS prism, 1/4 wavelength plate (1/4-wave film), and die clo prism, Reduction of the

attachment trouble of parts and simplification of attachment structure are attained, low-cost-izing and improvement in productivity can be realized, and an optical path can be shortened and an optical head can be miniaturized. And since this synthetic light faculty article 33 has the composition which incorporated each film in the glass of block like shape (six face pieces, such as a cube and rectangular parallelepiped shape), it can simplify a manufacturing process. That is, by cutting this glass block 40 at an angle of predetermined, after putting the PBS coat film 41, the 1/4 wavelength plate 42, and the die clo coat film 43, respectively and unifying between the plate-like glass plate base materials of a large area of four sheets, Since it can mass-produce by batch processing, manufacture trouble is simplified substantially. The interval between PD35 and the 2nd LD36 can be variously set up by adjusting the interval between the PBS coat film 41 and the die clo coat film 43.

[0012]

[Effect of the Invention]As explained above, according to this invention, the following outstanding effects are acquired. The 1st optical path in which the invention of claim 1 has arranged the 1st laser light source, PBS prism, 1/4 wavelength plate, and the dichroic prism one by one, In the optical head provided with the 2nd optical path that comprises said 2nd laser light source with a hologram, and said dichroic prism, Since PBS prism, 1/4 wavelength plate, and the dichroic prism were unified and it was considered as the single synthetic light faculty article, Reduction of the attachment trouble of parts and simplification of attachment structure are attained, low-cost-izing and improvement in productivity can be realized, and an optical path can be shortened and an optical head can be miniaturized. To claims 2, 3, and 4, since the synthetic light faculty article of respectively a statement is the plate type which carried out laminate integration of an PBS coat film, 1/4 wavelength plate, and the die clo coat film one by one by a proper order at each field of one sheet or two glass substrates, respectively, a manufacturing process can be simplified. Since the synthetic light faculty article according to claim 5 is the composition which carried out the direct lamination unification of an PBS coat film, 1/4 wavelength plate, and the die clo coat film not using the glass substrate, it can attain slimming down and can contribute to the miniaturization of an optical head further. Since the synthetic light faculty article according to claim 6 is provided with the composition which separated the necessary interval and has arranged the PBS coat film, 1/4 wavelength plate, and the die clo coat film one by one inside a glass block, Reduction of the attachment trouble of parts and simplification of attachment structure are attained like a statement to claim 1, low-cost-izing and improvement in productivity can be realized, and an optical path can be shortened and an optical head can be miniaturized.

[Translation done.]